ARCHÆOLOGICA MEDICA.

XXXVI.—STEPHEN HALES, A PIONEER IN MODERN PHYSIOLOGY.

The name of Stephen Hales is known to every medical student in connection with the first experiments upon blood pressure, but there are few students or teachers who know more of him than that he was in the Church and that he was a pioneer in the physiology of the vascular system whose discoveries were secondary only in importance to those made by Harvey himself. Yet Hales was a most remarkable man, and his physiological work filled only a small part of his interesting life.

Hales was born at Bekesbourne in Kent in September, 1677, graduated at Corpus Christi College, Cambridge, in 1696, and was created D.D. of the University of Oxford in 1733. He was appointed perpetual curate of Teddington, Middlesex, in 1708, but he soon became a pluralist, for he held the living of Porlock in Somersetshire, which he vacated for that of Farringdon in Hampshire. He was elected a Fellow of the Royal Society November 20th, 1718, receiving the Copley medal in 1739, and in 1753 he was elected one of the eight foreign members of the French Academy. He was proctor for the clergy of the diocese of Winchester, and he was one of the trustees for the colony of Georgia, then newly founded. He married Mary, daughter of Dr. Richard Newce, of Much Hadham, Hertfordshire, but had no children. He died January 4th, 1761, and is buried at Teddington. The Princess of Wales, mother of George III, put up a monument to his memory in Westminster Abbey.

Hales had so scientific a mind that it is said "he could look even upon wicked men and those who did him unkind offices without any emotion of particular indignation; not from want of discernment, but because he considered them only like those experiments which, upon trial, he found could never be applied to any useful purpose, and which he therefore calmly and dispassionately laid aside." His work falls naturally into two parts, says Professor Francis Darwin, (1) physiological and chemical, (2) inventions and suggestions on matters connected with health and agriculture. As he was a pioneer in the physiology of the vascular system, so he was equally foremost as a botanical physiologist. In his second character he invented artificial ventilators for ships, prisons, and granaries, and he manufactured an instrument for taking deep sea soundings. Yet he did not neglect his more purely spiritual duties, for he wrote against the mischief of dram drinking, and he made his female parishioners do public penance for irregular behaviour.

Hales's blood-pressure experiments were as simple as they were effective, and he describes them in the plainest and shortest manner. He gives the following account of his first satisfactory experiments:

"In December [1732 ?] I caused a mare to be tied down alive on her back. She was 14 hands high and about 14 years of age, had a fistula on her withers, was neither very lean nor yet lusty. Having laid open the left crural artery, about 3 inches from her belly, I inserted into it a brass pipe whose bore was one-sixth of an inch in diameter, and to that, by means of another brass pipe which was fitly adapted to it, I fixed a glass tube of nearly the same diameter, which was 9 feet in length; then, untying the ligature on the artery, the blood rose in the tube 8 feet 3 inches perpendicular above the level of the left ventricle of the heart.....Then I took away the glass tube and let the blood from the artery mount up in the open air, when the greatest height of its jet was not above 2 feet.

"Experiment II.—In January I caused a gelding to be tied down fast on his back, in the same manner as the mare was in the foregoing experiment. He was 13 hands high and 10 or 11 years old, but very lame by reason of a canker in his hoof; he was lean, but somewhat lustier than the mare and much more lively. I fixed the same brass pipe and glass tube as above to his left crural artery. The blood rushed up the tube at once to near two-thirds of its greatest height, and then more leisurely. It would rise and fall commonly 1 inch at each pulsation of the heart, but sometimes 2 or 3 inches. The blood rose to a height of 9 feet 8 inches. The horse's pulse beat 40 strokes in a minute before he was disturbed or tied down, but when the glass tube was fixed to the artery it beat 65 in a minute; and as the horse grew fainter (from loss of blood) the pulse was more and more accelerated so as to beat 100 times or more in a minute.

"Experiment III.—In December I laid a common field gate on the ground with some straw upon it, on which a white mare was cast on her right side, and in that posture bound fast to the gate. She was 14 hands and 3 inches high, lean, though not to a great degree, and about 10 or 12 years old. Then laying open the left jugular vein, I fixed to that part of it which comes from the head, a glass tube which was 4 feet and 2 inches long. The blood rose in it in 3 or 4 seconds of time about a foot, and then was stationary for 2 or 3 seconds; then in 3 or 4 seconds more it rose sometimes gradually and sometimes with an unequally accelerated motion, 9 inches more on some small strainings of the mare. The diameter of the brass pipe and tube which were fixed to the vein were nearly one-seventh of an inch: the diameter of the jugular vein nearly half an inch. Then, laying bare the left carotid artery, I fixed to it, towards the heart, the brass pipe, and to that the windpipe of a goose, to the other end of which a glass tube was fixed, which was 12 feet 9 inches long. The design of using the windpipe was by its pliancy to prevent the inconveniences that might happen when the mare struggled, if the tube had been immediately fixed to the artery without the intervention of this pliant pipe."

Hales killed each of the three animals by bleeding, taking away the blood quart by quart, and noting the alteration in the column of blood as each quart was removed. He says, "We may observe that these three horses all expired when the perpendicular height of the blood in the tube was about 2 feet, the number of quarts of blood lost being respectively 16, 15, and 15."

But the whole of the *Statical Essays* containing Hæmastatics well repay perusal even at the present day. They have twice been translated into French, and once into German, Italian, and Dutch. A note at the end of the preface to the third edition of the first volume is interesting, as it gives us an insight into the amount of education possessed by our ancestors even as late as 1769. It runs, "Whereas some complain that they do not understand the signification of these short signs or characters which are here made use of in many of the calculations, and which are usual in algebra: this mark + signifies 'more,' or 'to be added to.' Thus 6 ounces + 240 grains, is as much as to say 6 ounces more by or to be added to 240 grains. And this mark × or cross signifies 'multiplied by'; the two short parallel lines signify 'equal to'—thus 1820 × 4 = 7280 : 1 is as much as to say 1820 multiplied by 4, equal to 7280 is to 1."

THE SERUMTHERAPY OF YELLOW FEVER.

A Reuter's telegram from Monte Video announces that Professor Sanarelli gave a lecture at Monte Video on October 13th on the Serumtherapy of Yellow Fever, and expressed the hope that serum obtained from vaccinated animals would be efficacious for the cure of yellow fever in human beings.

In *Il Policlinico* of September 15th and the *Annali di Medicina Navale* for September-October Professor Sanarelli published a paper on the Production of Immunity to Yellow Fever by Injection of Protective Serum, in the course of which he describes his experiments on animals, including those on a horse, from which, it would appear, he has obtained the curative serum for human yellow fever. The paper is dated Monte Video, July 24th, 1897.

The Serum of Cadavers and Convalescents from Yellow Fever.

The author first describes his experiments with the serum of cadavers from yellow fever taken very soon after death from the blood of the heart, but it had no preventive power in respect to the specific bacillus. He also obtained a considerable quantity of the serum of a convalescent from the disease which produced the Grüber-Durham reaction with great slowness, and manifested a weak protective action in animals in respect to the bacillus icteroides. The simultaneous injection of the serum and the virus did not prevent the death of the guinea-pig, but death did not occur in the greater number if the injection of the serum in a dose of at